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tal plane. Similarly a line in space will be represented in general by *two* lines in the plane. If two lines intersect in space their projections meet in points lying on a line perpendicular to the ground line. Let

$$y=m_ix+c_i \text{ and } y=h_ix+k_i \quad (i=1, 2, 3, 4)$$

be the projections of four arbitrary lines in space, the ground line being taken as the X-axis. Cut them respectively by the lines $y=Mx+C$ and $y=Hx+K$. If the abscissas of the corresponding points of intersection are equal, the space line whose projections are $y=Mx+C$ and $y=Hx+K$ will cut the four given lines. These conditions are

$$\frac{c_i-C}{M-m_i}=\frac{k_i-K}{H-h_i} \quad (i=1, 2, 3, 4)$$

or $Mk-HC-m_iK+h_iC+c_iH-k_iM-h_ic_i+m_ik=0$.

These four equations have in general *two* independent sets of solutions for for M, K, C, H, showing, therefore, that two lines meet the four space lines.

DEPARTMENTS.

SOLUTIONS OF PROBLEMS.

ALGEBRA.

99. **Proposed by C. H. JUDSON,**[*] **Professor of Mathematics, Furman University, Greenville, S. C.**

Seven persons met at a summer resort and agreed to remain as many days as there are ways of sitting at a round table, so that no one shall sit twice between the same two companions. They remained fifteen days. It is required to show in what way they may have been seated.

Solution by F. H. SAFFORD, Ph. D., The University of Pennsylvania.

ABCDEFG,
ADFEBGC,
AEGBDCF,
ACEDFBG,
AFBEGDC,
AGDBCEF,
ADBFCEG,
AEDGFBC,
ABECGEF,
AEBDFCG,
ABDEGFC,
ADEBCGF,
ADCGEFB,
AEFCBGD,
ABGFDCE.

I believe that all solutions for seven persons may be obtained from that above by permutations of letters.

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[*] March, 1899; March 1900. The general problem is treated by group theory by L. E. Dickson in an article offered February, 1904, to the *Annals of Mathematics*. A third solution for six persons is there given.

For six persons there appear to be two independent solutions, the one previously given by Dr. Judson, and the following:

ABCDEF, ACEBDF,
ABDCFE, ACBEFD,
ABEDFC, ADECBF,
ABFECD, ADBFCE,
ACDFBE, AEDBCF.

192. Proposed by **F. P. MATZ, Sc. D., Ph. D.,** Professor of Mathematics and Astronomy in Defiance College Defiance, O.

What is the difference between the squares of the two *infinite* continued fractions $\left(3+\frac{1}{6+\text{etc.}}\right)$ and $\left(2+\frac{1}{4+\text{etc.}}\right)$?

Solution by **G. B. M. ZERR, A. M., Ph. D.,** Parsons, W. Va., and **L. E. NEWCOMB,** Los Gatos, Cal.

Denote the value of the continued fractions by x and y.

$$\text{Then } x-3=\frac{1}{6+x-3}=\frac{1}{x+3},\ \therefore x^2-9=1,\ x^2=10,\ x=\sqrt{10};$$

$$y-2=\frac{1}{4+y-2}=\frac{1}{y+2},\ \therefore y^2-4=1,\ y^2=5.\ y=\sqrt{5}.$$

$\therefore x^2-y^2=5=$required result.*

194. Proposed by **L. E. DICKSON, Ph. D.,** The University of Chicago.

In the determination of the canonical forms of Abelian transformations modulo p, one is led to the type $[b_1, b_2, b_3]$:

$$\xi_1'=\xi_1,\ \eta_1'=b_1\xi_1+\eta_1+b_2\xi_2+\eta_2+b_3\xi_3+\eta_3,\ \xi_2'=\xi_2-\xi_1,$$
$$\eta_2'=\eta_2+b_2\xi_2,\ \xi_3'=\xi_3-\xi_1,\ \eta_3'=\eta_3+b_3\xi_3.$$

Find its period and determine the conditions under which it is conjugate with $[c_1, c_2, c_3]$ under Abelian transformation.

Solution by PROPOSER.

By mathematical induction, we verify that the kth power of $[b_1, b_2, b_3]$ is

$$\xi_1'=\xi_1,\ \eta_1'=[kb_1-\tfrac{1}{6}k(k^2-1)(b_2+b_3)]\xi_1$$
$$+\eta_1+\tfrac{1}{2}k(k+1)(b_2\xi_2+b_3\xi_3)+k\eta_2+k\eta_3,$$
$$\xi_2'=\xi_2-k\xi_1,\ \eta_2'=\eta_2+kb_2\xi_2-\tfrac{1}{2}k(k-1)b_2\xi_1,$$
$$\xi_3'=\xi_3-k\xi_1,\ \eta_3'=\eta_3+kb_3\xi_3-\tfrac{1}{2}k(k-1)b_3\xi_1.$$

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*Solutions based on the following interpretations are desirable. Ed.

$$3+\cfrac{1}{6+\cfrac{1}{12+\cfrac{1}{24+\text{etc.}}}}\qquad 2+\cfrac{1}{4+\cfrac{1}{8+\cfrac{1}{12+\text{etc.}}}}\qquad 3+\cfrac{1}{6+\cfrac{1}{9+\cfrac{1}{12+\text{etc.}}}}\qquad 2+\cfrac{1}{4+\cfrac{1}{6+\cfrac{1}{12+\text{etc.}}}}$$